

one *P. aganice*, two *J. clelia*, three male *H. missippus*, one *P. tropicalis*, two *P. brasidas*, two *P. demodocus*, one *P. lyæus*, and two *B. forestan*. He ate every one without the least hesitation, and evidently appreciated them, as he would follow me about, waiting for more.

April 1. Gave ground horn-bill one *A. petraea*, two *A. cubira*, one *P. brasidas*, one male *H. missippus*, and one *P. esebria*, all of which he ate readily.

[It has already been pointed out that the acceptance of insects by insectivorous animals in captivity is no proof of their normal likes or dislikes in a wild state. Such acceptance only proves what their action would be when they had been, from some exceptional cause, kept without their normal food in its usual quantity and variety. Hence the fact that the *Acræas* were devoured is no evidence that they are normally eaten except in a time of unusual hunger. On the other hand, the rejection of two *L. chryseippus*, after three *Acræas* had been readily eaten, indicates that the former butterfly is decidedly distasteful to this species of bird. It must be remembered that five *Acræas* were freely eaten on the next occasion. A comparison with the experiments on Mantides is interesting.—E. B. P.]

11. THE INSECT-FOOD OF WILD SOUTH AFRICAN BIRDS. (G. A. K. M.)

[Even more important than the results of experiments are the observations made and collected by Mr. Marshall upon the contents of the stomachs of birds, and the record of actual attacks made by birds upon insects, which have been witnessed in the field. The contents of birds are clearly shown in the two following tables, A and B, which are printed just as I received them from Mr. Marshall, except that I have added a brief description of the general appearance of those insects which seemed to require it. Mr. Marshall had only supplied such a description in three or four cases. In future records of this kind it will be advisable for the observer on the spot to supply such notes, together with a brief account of the habits, inasmuch as conspicuousness or concealment depend upon these quite as much as upon colour and pattern.—E. B. P.]

TABLE A.—Contents of birds, probably 1898, unless otherwise stated, and Salisbury when no other locality is mentioned.

BIRDS.	INSECTS, ETC.	GENERAL APPEARANCE OF INSECTS.
<i>Macronyx capensis.</i>	COLEOPTERA, <i>Cleonus</i> sp., <i>Eremnus</i> sp., <i>Syagrus</i> <i>puncticollis</i> , Lefèv., <i>Sympieziorrhynchus</i> sp.	<i>Syagrus</i> ,* a shining black, medium-sized Phytophagous beetle (<i>Eumolpidae</i>). All others are weevils, and probably all with cryptic colouring.
<i>Irrisor erythrorhynchus.</i>	HOMOPTERA, <i>Pyrops</i> sp. COLEOPTERA, <i>Platypria</i> <i>mashuna</i> , Pér., <i>Anthaxia</i> sp.	<i>Pyrops</i> , at rest are red-brown or greyish insects. <i>Platypria</i> , tawny with brown spots, very spinous (<i>Hispidae</i>). <i>Anthaxia</i> , small green or coppery Buprestid.
<i>Coracias garrula.</i>	COLEOPTERA, <i>Gymnopleurus</i> <i>fastiditus</i> , Har.	Large, sooty-black, smooth Scarabæid.
<i>C. caudata.</i>	CRABS. COLEOPTERA, <i>Agrilus</i> sp., <i>Anthia pachyoma</i> (!).	<i>Agrilus</i> , small Buprestids, colour varies. <i>Anthia</i> , huge black Carabid with very powerful mandibles.
<i>C. spatulata.</i>	DIPTERA, fly-maggots from carrion.	
<i>C. olivaceiceps.</i>	ORTHOPTERA, <i>Phymateus</i> <i>morbillosus</i> , L. (a large evil-smelling bright-green locust with purple and crimson hind-wings).	Very conspicuous, with red thorax and head; legs red and yellow.
<i>Melittophagus pusillus.</i>	COLEOPTERA, <i>Oonthophagus</i> , sp.	Genus of <i>Scarabæidae</i> , varying much in size: metallic or black.
<i>Merops natalensis.</i>	COLEOPTERA, <i>Mylabris</i> <i>oculata</i> , Thunb. (!).	Characteristic Cantharid, aposematic, orange and black colours.
<i>Cuculus gularis.</i>	COLEOPTERA, <i>Nyassinus</i> <i>lugubris</i> , <i>Sphenoptera</i> <i>disjuncta</i> , <i>Hoplonyx</i> sp.	<i>Nyassinus</i> , small red-brown, rough Cetoniid, probably cryptic. <i>Sphenoptera</i> , dark metallic, coppery, moderate-sized Buprestid. <i>Hoplonyx</i> , medium-sized, black often polished, Heteromera (<i>Tenebrionidae</i>).
<i>Asturimula monogrammica.</i>	ORTHOPTERA, <i>Clonia wahlbergi</i> . CENTIPEDES.	<i>Clonia</i> is a fine Locustid living among the leaves of trees. It is certainly procryptic.
<i>Fulco subbutco.</i>	COLEOPTERA, <i>Pentodon</i> <i>nireus</i> , Burm., <i>Onitis</i> <i>alexis</i> , <i>Anomala</i> sp.	<i>Pentodon</i> , large black Dynastid. <i>Onitis</i> , medium-sized Scarabæid, elytra and legs, brown; thorax iridescent green. <i>Anomala</i> , pale yellow brown, or metallic <i>Rutelidae</i> ; moderate-sized beetles.

TABLE A.—(continued.)

BIRDS.	INSECTS, ETC.	GENERAL APPEARANCE OF INSECTS.
<i>Cerchaeis rupicoloides.</i>	CENTIPEDES.	
<i>C. naumanni.</i>	COLEOPTERA, <i>Heteronychus licas</i> , Klug., CENTIPEDES. ARACHNIDS, <i>Solpuga murshulli</i> , Poc.	<i>Heteronychus</i> , smallish black, rather shining Dynastid. <i>Solpuga</i> is red-brown, distal part of 4th leg black, broad median black band on abdomen which is clothed at sides with yellowish-white hairs. It runs very swiftly and its habits are strongly proeryptic.
<i>C. amurensis.</i>	COLEOPTERA, <i>Hylaticus</i> , sp.	Moderate-sized, oval, polished dark-brown <i>Dytiscidae</i> .
<i>Bubo maculosus.</i>	COLEOPTERA, <i>Hesperophanus amirus</i> , white.	A large red-brown Cerambycid: proeryptic.
<i>Herodias lucidus.</i>	Dragon-flies and aquatic Hemiptera.	
<i>Ciconia abdimii.</i>	COLEOPTERA, <i>Psammodes ventricosus</i> , Fahr., <i>P. scabratus</i> , Gerst., <i>Polyhirna semisaturata</i> , Chd., <i>Piezia murshulli</i> , Pér., <i>Scarites</i> , sp. HYMENOPTERA, Ants of the genus <i>Carchara</i> .	<i>Psammodes</i> , both species are large dull-brown Tenebrionid Heteromera. <i>Polyhirna</i> , moderate-sized, black Carabid with white markings. <i>Piezia</i> , a Carabid superficially similar to last. <i>Scarites</i> , shining black Carabids of variable size; large mandibles.
<i>Namula coronata.</i> Shot by C. F. M. Swymerton at Mazoe, Mashonaland, 4000 ft.	COLEOPTERA, 2 <i>Psiloptera chalcophoroides</i> , Pér., 1 <i>Hipporhinus bohemanii</i> , Fahr., 1 <i>Phantasia gigantea</i> , Guér., 1 <i>Macrocoma aurcorilosa</i> , Mash. These five specimens were taken from the crop, December 25, 1898, by Guy A. K. Marshall. They are now in the Hope Collection, Oxford, and are extraordinarily perfect, retaining the legs and in some cases the antennae.	<i>Psiloptera</i> , largish iridescent bright-green Buprestids. <i>Macrocoma</i> , a small golden-green iridescent Phytophagous beetle. <i>Hipporhinus</i> , a large brown rough cryptic weevil. <i>Phantasia</i> , a large Longicorn generally similar to the above, and probably mimetic of certain very hard <i>Curculionidae</i> .
<i>Merops natalensis</i> , September 1901.	LEPIDOPTERA HETEROCERA, the Saturniidae <i>Pseudaphelia apollinaris</i> and <i>Cirina similis</i> .	The moths both conspicuous, slow, day-flying, and probably distasteful species. <i>Pseudaphelia</i> , is large semi-transparent, whitish with black markings; <i>Cirina</i> is still larger and dull pink.

TABLE B.—*Insects, etc., in stomachs of birds (probably 1898), Salisbury.*

COLEOPTERA.	BIRDS.
<i>Polycleis decorus</i> (largish weevil, varying much in colour, but always with more or less of a pattern).	<i>Oriolus notatus</i> , <i>Coracias caudata</i> , <i>Halcyon pallidiventris</i> .
<i>Trochilus</i> sp. (small rounded often polished black-brown or greenish Lamellicornis; probably mimics of <i>Galerucidæ</i> , <i>Chrysomelidæ</i> , and <i>Coccinellidæ</i>).	<i>Bradyornis mariquensis</i> , <i>Fringillaria talu-pisi</i> .
<i>Cassida</i> (<i>Aspidomorpha</i>) <i>punctata</i> , F. (medium size, abundantly black-spotted, colour probably reddish-brown when fresh).	<i>B. mariquensis</i> , <i>Irrisor erythrorrhynchus</i> , <i>Campothera bennetti</i> .
<i>Alcides hæmopterus</i> , Boh. (smallish weevil with red-brown white-spotted elytra and black thorax and head).	<i>Prionops talucoma</i> .
<i>Oosomus</i> sp. (an entirely black, arboreal or subcortical weevil).	<i>Graucalus pectoralis</i> , <i>Upupa africana</i> , <i>Irrisor erythrorrhynchus</i> , <i>Campothera bennetti</i> .
<i>Zophosis</i> sp. (black quick-running Heteromeran).	<i>Geocichla litsitsirupa</i> .
<i>Onthophagus gazella</i> (smallish Scarabæid with brown elytra and iridescent dark-green thorax and head).	<i>Caprimulgus rufigena</i> , <i>Falco subbuteo</i> (in large numbers).
OTHER INSECTS, ETC.	
Pentatomid bugs.	<i>Geocichla litsitsirupa</i> , <i>Laniarius guttatus</i> , <i>Irrisor erythrorrhynchus</i> , <i>Cerchneis amurensis</i> , <i>Coceystes glandarius</i> .
Reduviid bugs.	<i>Macronyx capensis</i> , <i>Rhinopomastus cyanomelas</i> .
Ant-lion larvæ.	<i>Thamnotæa cinnamomeiventris</i> .
Ants.	<i>Bradyornis mariquensis</i> , <i>Pratincola torquata</i> , <i>Monticola angolensis</i> , <i>Saxicola pileata</i> , <i>Buchanga assimilis</i> , <i>Thamnotæa cinnamomeiventris</i> , <i>Crateropus kirkii</i> , <i>Lophoceros leucomelas</i> , <i>Campothera bennetti</i> , <i>Crecopsis egregia</i> .

TABLE B.—(continued.)

OTHER INSECTS, ETC.	BIRDS.
Other Hymenoptera.	<i>Rhinopomastus cyanomelas</i> , and all four species of bee-eaters.
Hairy caterpillars.	<i>Oriolus larrvatus</i> , and all the cuckoos.
Millepedes.	<i>Turdus libonyanus</i> .
Scorpions.	<i>Coracias olivaceiceps</i> , <i>Cerchneis rupicoloides</i> , <i>Asturinaula monogrammica</i> (apparently favourite food with this species).
VERTEBRATES.	
Lizards.	<i>Melirrac polygonus</i> , <i>Astur polygonoides</i> , <i>Aquila wahlbergi</i> , <i>Circatus pectoralis</i> , <i>Cerchneis rupicoloides</i> , and <i>Glaucidium perlatum</i> .
Snakes.	<i>Astur polygonoides</i> , <i>Butco jakal</i> , <i>Circatus pectoralis</i> , <i>Bubo maculosus</i> .

RESULTS OF TABLES A AND B.

[The almost complete absence of the members of aposematic Coleopterous groups is very marked. In fact, the whole of the numerous beetles are probably cryptic, with the following exceptions. The species of the Eumolpid genus *Syagrus* is probably distasteful; for it freely exposes itself on leaves, where its shining black appearance renders it conspicuous. It is worthy of note that the only bird in which it was found, *Macronyx capensis*, also ate Reduviid bugs. The Phytophagous *Macrocoma aurcovillosa* belongs to a probably distasteful group, but it is itself green in colour; it was only eaten by one species. The Hispid *Platypria* is probably distasteful, and here too the only species of bird which ate it, *Irrisor erythrorrhynchus*, also ate the conspicuous *Cassida (Aspidomorpha) punctata* and Pentatomid bugs. The above-named Cassid was also found in two other species of bird. The most remarkable exception is however the typically-coloured Cantharid, *Mylabris oculata*, only detected in *Merops natalensis*. Here we find the interesting proof that under certain circumstances, and with certain enemies, the most marked distasteful

or unwholesome qualities accompanied by the most conspicuous orange and black aposematic coloration may afford no protection. Furthermore, it is of great interest to observe that the same species of bird was the only one in which two conspicuous and almost certainly distasteful Saturniid moths were found. The *Carabidae* of the genera *Anthia*, *Polyhirma*, *Piezia*, and *Scarites* are not so remarkable. *Scarites* is probably nocturnal and entirely procryptic, while the defensive secretions of the three other genera may be discharged and lost as the result of the attacks of an experienced enemy.

Outside the Coleoptera, the number of birds which ate Pentatomid bugs is remarkable (five species), and it would be interesting if it were possible to obtain the remains and make out the species of these Hemiptera. The specialization of enemies to feed upon forms which have become excessively abundant through specialization in their modes of defence is seen in the two species which contained ants, and the three which had eaten scorpions. The hairy caterpillars eaten by cuckoos are a similar case; this group of birds being specialized to feed on insects which are specially defended against the majority of insect-eaters. The fact that *Phymateus morbillosus*, a large, conspicuous, and strong-smelling locust, had been eaten, is also of interest. *Solpuga marshalli*, in spite of its formidable appearance, is quite harmless, with procryptic appearance and habits. The Tables as a whole afford wonderfully strong support to the existing theories which explain cryptic colouring and instinct as the defence of forms which are eagerly sought for as food by numerous enemies, and an aposematic appearance and mode of life as the defence of specially-protected forms only attacked under the stress of hunger or by comparatively few specially-adapted foes.—E. B. P.]

12. RECORDS OF ATTACKS ON LEPIDOPTERA, ESPECIALLY BUTTERFLIES, BY WILD SOUTH AFRICAN BIRDS. (G. A. K. M.)

[The stimulus which induced Mr. Marshall to collect observations on the attacks of birds upon butterflies was provided chiefly by the account of the discussion which followed Dr. F. A. Dixey's paper on "Mimetic Attraction" (Trans. Ent. Soc. London, 1897, p. 317; Discussion in TRANS. ENT. SOC. LOND. 1902.—PART III. (NOV.) 24